

# The impact of training era on the outcomes of transurethral prostatectomy

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## Introduction

Transurethral prostatectomy (TURP) is the gold-standard surgical treatment for benign prostatic hyperplasia (BPH).<sup>1,2</sup> To optimize surgical proficiency and outcomes, a TURP requires a significant amount of practice. TURP was once the most common procedure in older patients (after cataract surgery) and, therefore, most urologists rapidly attained significant proficiency in this procedure.<sup>3</sup> The rapid expansion of medical therapy in the 1990s and more recently of new surgical technologies has reduced the total number of electrosurgical TURP procedures being performed at most institutions.<sup>3</sup> While trainees are adept at managing BPH-related lower urinary tract symptoms (LUTS) with medications, it has been our observation that some residents struggle with attaining surgical proficiency with TURP. Since TURP procedures typically occur after the failure of medical management, the patients tend to be more comorbid, of advanced age, and have larger prostates that have grown over years, thus making the cases more complex.<sup>1,2</sup> It has been our impression that the volume of TURP procedures that residents are currently being exposed to is anecdotally lower than previously described by more senior surgeons who trained in the 1980s and 1990s. In addition, novel TURP procedures have been developed and are being taught at various institutions, and this changing practice further dilutes resident experience of each individual technology.

Our objective was to determine if the re-operation rate after an initial TURP is different among urologist that were trained in a more contemporary era with predominately medical management of BPH symptoms compared to more senior urologists.

## Methods

We conducted a retrospective, population-based, cohort study using routinely collected administrative datasets from the province of Ontario, Canada, and held at Institute for Clinical Evaluative Sciences (ICES). We identified all men over the age of 40 years who had their first TURP from 2003–2016. We excluded patients with prior possible prostate cancer, TURP, or simultaneous bladder tumor resection. A full description of our data sources, methodology, covariates and coding definitions are included in our prior work.<sup>4</sup> The primary exposure was the year of medical school graduation of the operating surgeon: those graduating prior to 1995 were considered part of the surgical management (higher-volume) era and those graduating after 1995 were considered part of the medical management (lower-volume) era of BPH. Our primary outcome was a repeat TURP being performed more than 14 days after the initial procedure. Secondary outcomes included 30-day emergency room visits and seven-day blood transfusion rates. Several covariates were measured, including year of procedure, type of hospital (academic vs. community), TURP modality (electrical vs. laser), indications for TURP, gross hematuria, urinary tract infections, acute urinary retention, diabetes, and concomitant bladder stone treatment. Baseline surgeon demographic information on the number of TURP procedures in the five years prior to the event date was measured. Our primary analysis was an adjusted marginal Cox regression model with a robust sandwich covariance matrix, which accounted for covariates, patient clustering within surgeons, and the surgeon's prior TURP experience;<sup>5</sup> our secondary analyses were adjusted logistic regression models. Adjustment was made for all patient covariates that had a statistically significant difference between groups. A p-value<0.05 was considered significant. All analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC, U.S.). The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board.

## Results

We identified 78 176 men, with a median age of 72 years (interquartile range [IQR] 65–79) that met our inclusion criteria. The majority of TURPs in our timeframe were performed by urologists in the high-volume era (n=63 223) compared to those in the low-volume era (n=14 953) (Table 1). A total of 314 different urologists performed TURPs over the study period, and median number of prior TURPs performed was 402 (IQR 232–720) for the high-volume generation vs. 172 (IQR 73–331) for the low-volume generation (Table 1).

After a median follow up of five years (IQR 2–8), the repeat TURP rate/100 person-years was 2.05 (95% confidence interval [CI] 2.00–2.10) for patients treated by the high-volume generation vs. 2.63 (95% CI 2.50–2.76) treated by the low-volume generation.

In our adjusted survival model (which also adjusted for number of prior TURPs), patients of the low-volume TURP generation had an increased hazard ratio for reoperation of 1.19 (95% CI 1.11–1.26,  $p < 0.01$ ). In a subgroup analysis, the hazard ratio remained significant between the two groups for electrical TURPs (1.20, CI 1.01–1.42) but not for laser TURPs (1.08, CI 0.9–1.29). The adjusted odds ratio for emergency room visits after TURP and perioperative blood transfusion were 1.01 (95% CI 0.97–1.06,  $p = 0.61$ ) and 0.92 (95% CI 0.79–1.06,  $p = 0.22$ )<sup>6</sup> between high- and low-volume surgeons, respectively.

## Discussion

The monopolar TURP was the first successful, minimally invasive procedure in the modern era to treat BPH related LUTS, and impressively has remained the gold-standard surgical procedure over time. Our study demonstrates that patients of urologists that were trained after 1995 have a slightly higher repeat TURP rate compared to patients who had their procedure by more senior surgeons. This finding supports the hypothesis that current residents may not be achieving peak competency levels during their training compared to their predecessors. While there is certainly a learning curve for TURP, studies for other BPH technologies generally consider this to be only 50 cases,<sup>7</sup> which most of the surgeons in this study have easily surpassed. The volume and feedback while performing TURPs during residency may be an important consideration for competency-based training. Due to the perceived lower number of TURPs in modern-day urology, there may be an important role for simulator-based teaching and community rotations during residency. Our results may be translatable to other urological procedures that are becoming less common (including open surgical procedures).

Limitations of our study include the fact that we do not have actual data on the number of TURPs performed during urology residency prior to 1995 vs. after 1995. Not all relevant covariates could be measured (such as prostate

**Table 1. Patient demographics comparing the high-volume TURP era patients to the low-volume era patients**

Variable	Statistic	High-volume era	Low-volume era	p <sup>b</sup>
Total patients	N	63 223	14 953	
Demographics				
Age	Median (IQR)	72 (65–79)	71 (64–78)	<0.01
Type of hospital for TURP	Academic	7816 (12.4%)	1940 (13.0%)	0.05
	Community	55 407 (87.6%)	13 013 (87.0%)	
Gross hematuria 6 months prior to TURP	n, yes (%)	14 253 (22.5%)	3388 (22.7%)	0.77
UTI 6 months prior to TURP	n, yes (%)	2218 (3.5%)	579 (3.9%)	0.03
Acute urinary retention 6 months prior to TURP	n, yes (%)	26 475 (41.9%)	6194 (41.4%)	0.31
Type of TURP procedure	Laser	6687 (10.6%)	2669 (17.8%)	<.01
	Electrical	50 316 (79.6%)	11 119 (74.4%)	
	Unknown <sup>a</sup>	6220 (9.8%)	1165 (7.8%)	
Concomitant bladder stone treatment	n, yes (%)	5078 (8.0%)	1686 (11.3%)	<0.01
Diabetes	n, yes (%)	12 516 (19.8%)	3306 (22.1%)	<0.01
Surgeon characteristics				
Years since medical school graduation	Median (IQR)	28 (21–34)	11 (8–13)	
Prior number of TURPs performed by urologists	Median (IQR)	402 (232–720)	172 (73–331)	
	<250	17 594 (27.8%)	9765 (65.3%)	
	250–499	20 437 (32.3%)	3373 (22.6%)	
	500–749	10 247 (16.2%)	1185 (7.9%)	
	≥750	14 945 (23.6%)	630 (4.2%)	

<sup>a</sup>Some TURPs did not have an identifiable hospital procedure code that corresponded to either a laser or electro-surgical procedure. If both laser and electrical procedural codes were reported, we considered the type of TURP procedure unknown. <sup>b</sup>Two-sided p-values were used to identify significant differences (<0.05). IQR: interquartile range; TURP: transurethral prostatectomy; UTI: urinary tract infection.

size or weight resected). The difference in patient outcomes between these two groups of surgeons may be due to other factors, such as better patient selection, and this process may require a learning curve of hundreds of TURPs.

## Conclusions

There is a difference in the outcomes of patients undergoing TURP based on whether their surgeon was trained prior to or after 1995, and this may be due to differences in surgical volumes during their training.

**Competing interests:** The authors report no competing personal or financial interests related to this work.

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